RP74

1972 PROGRESS REPORT OF REHABILITATION PROJECTS ON I-90 "MONTANA LINE WEST" AND ASSOCIATED BARROW SITES

by Stephen Monsen

INTRODUCTION

In the fall of 1970, personnel from the Intermountain Forest and Range Experiment Station (IF&RES) were requested to inspect the Lookout Pass segment of I-90 by the Idaho Department of Highways, and assist in the development of planting procedures for revegetation of this road. Although a considerable portion of the rehabilitation program had previously been prepared by personnel of the Highway Department, changes were suggested by the IF&RES, particularly in the seed mixture and species applied.

Since revegetation of this segment of I-90 is of considerable expense to the State and presents areas which are extremely difficult to vegetate, a series of studies were established in the summer of 1971 to assess plant survival and growth responses. The initial program was developed by the IF&RES, and implemented with assistance from the Highway Department. Both agencies assumed individual costs which occurred during the 1970-71 period. However, to obtain a reasonable evaluation of the techniques and plant materials utilized in the planting, a continuing study lasting about 5 years was necessary. To assure the establishment of a properly designed study and the assimilation of data during this period, a more formal study was thus required.

In July 1972, an agreement was prepared in which the Highway Department assumed financial support of the studies already established by the

IF&RES. Some modifications of the initial program were necessary, and portions of the project have been enlarged. Although the initial agreement was confined to a 1-year period (1971-1972), studies were to be continued for 5 years through yearly renewals. The obligations and responsibilities assumed by both agencies are summarized in the 1971 Agreement, attached as Appendix I.

All major commitments listed in the 1972 Agreement have been completed, and subsequent yearly field surveys can be continued. The construction of the road and the preparation of the planting surfaces at the Lookout Pass area and the three barrow sites has taken 3 years to complete. The final phase was ended in the summer of 1972. Thus, study sites have been installed during each of the 3 years. The final series of plots are scheduled to be established in the summer of 1973.

As information has been accumulated, further improvements in the annual plantings were made, causing some adjustment in the sampling techniques. At the present time, all field data have been transferred to IBM cards for storage. Comparative analysis of 1- and 2-year-old plantings is currently being completed.

This report briefly summarizes the principle findings and accomplishments of the 1972 period. The information is presented by four major objectives, summarized from the initial project Agreement. In addition, the status of each study is reported and the projected activities necessary to complete specified assignments are described.

The areas disturbed by road construction near Lookout Pass have exposed numerous sites, which are most critical to revegetate. However,

conditions at this location are similar to problems of other roads in Idaho and surrounding states. The impacts of road construction have become increasingly important to the ecosystems aligning each route.

Although roads are difficult to rehabilitate, considerable emphasis is now being given to effectively vegetate even the more disturbed slopes. Our objectives are to develop planting techniques and plant materials useful in treating roads throughout the major plant communities and to identify species for different site conditions. Special emphasis is being given to the use of species which are compatible with the native vegetation, and can provide an effective and permanent cover. Procedures which would reduce planting costs, limit the number of unsuccessful plantings, and provide a more stable and aesthetic array of plants are also important considerations.

Since studies have been located upon large-scale plantings, completed over a 3-year period by different seeding contractors, the Highway Department has been able to evaluate separate plantings. Although the study has been of considerable importance in this regard, such that some adjustments have been made in the later plantings, the principle concern has been to investigate individual plant responses and planting techniques.

STUDY OBJECTIVES

I. Species Selection.--This involves the selection of species most capable of growing on cut and fill slopes at this location, with special emphasis given to native plants.

II. Site Preparation and Planting Procedures.--A primary objective is to evaluate "mini-benching" of cut slopes as a method for creating a bed for direct seeding and transplanting. In addition, we are concerned about factors contributing to plant establishment on both cut and fill slopes.

III. Environmental and Climatic Influences.--To fully evaluate individual plant success, climatic variables, soil conditions, and biotic factors must be assessed. Factors of this type are of considerable importance to plant survival, and road construction has created conditions that are foreign to native communities.

IV. Plant Composition Changes.--The development and changes in the plant composition, as influenced by time, are primary objectives of the study. An understanding of the development patterns will assist in determining future seed mixtures and plant materials to be utilized.

I. Species Selection

A series of studies have been established throughout both the roadway plantings on the "Mullan Line West" section of I-90 and the Big Creek barrow site. At both areas, studies have been arranged to evaluate the establishment, survival, and growth rates of individual species that were planted. And, to relate plant responses to soil conditions, elevation, aspect, cut and fill slopes, and other climatic variants.

First-year studies have concentrated upon the establishment and survival of young seedlings. Although most slopes contain a considerable amount of surface rock, seedlings survived well, even on the rocky faces of the mini-benches. No major losses of small plants were recorded in

either the 1971 or 1972 periods. Large areas were encountered with little or no plants, but these sites had not been seeded. Aerial photographs clearly reveal that on some slopes 30-50 percent of the area was missed in planting.

The seeded grasses have provided an effective cover, even during the seedling year or first growing season. An average ground cover, approximately 50 percent, was recorded on the fill slopes at the end of the first year. This was increased to about 70 percent in the second year (Figures 1-a and 1-b).

Although plants developed more slowly on the mini-benches, all seeded species were observed growing on the more harsh sites. First-year ground cover, provided by all plants, averaged about 15 percent on the level portions of the small benches and about 8 percent on the cut faces of each bench. These averages increased to 40 percent and 20 percent respectively at the end of the second growing season (Figures 2-a and 2-b).

A more detailed analysis of germination patterns and seedling survival was presented in a paper delivered during the 1972 WASHO meetings in Salt Lake City. The most significant factor has been the success of seeding native tree and shrub seeds directly upon the rough surfaces of the fill slopes, particularly the exposed rocky mini-benches. Over 45,000 tree and shrub seedlings were recorded per acre on fill slopes at the end of the first year, and approximately 26,000 plants became established throughout the mini-bench slopes. Tree and shrub seedling losses were recorded due to the competitive effects of the seeded

Figure 1.--Grasses quickly occupied the fill slopes within 1 or 2 years. Photo 1-a was taken in mid-July 1971, and 1-b was retaken in September 1972.

1-a

1-b

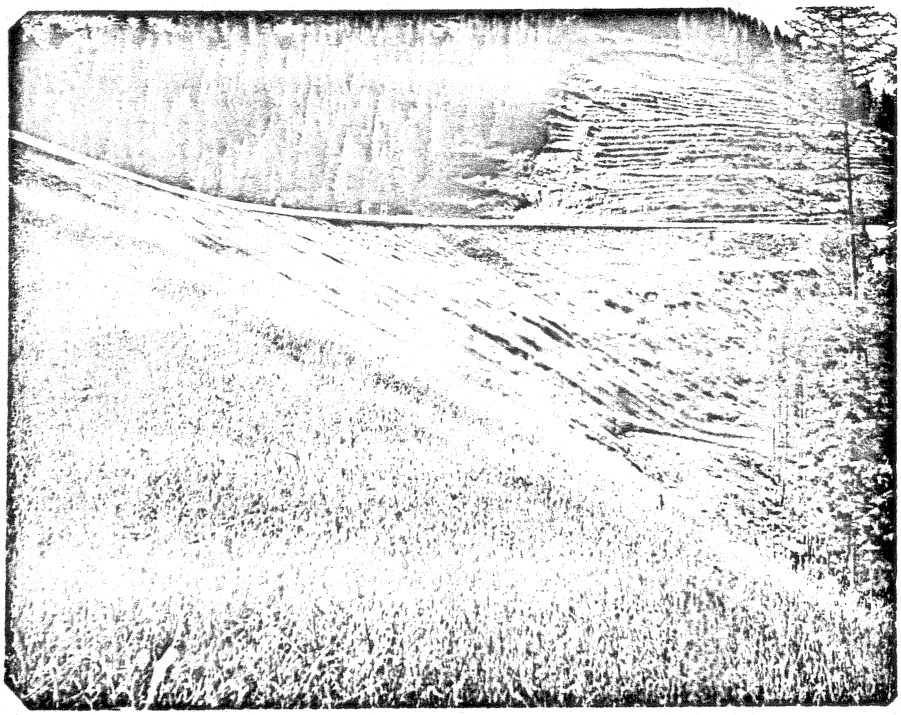
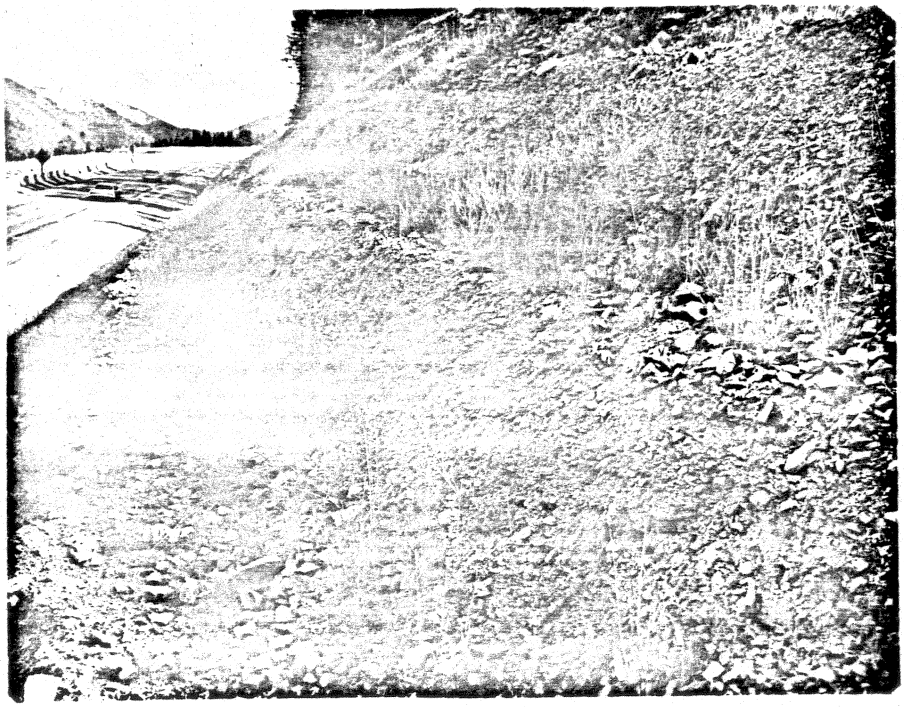
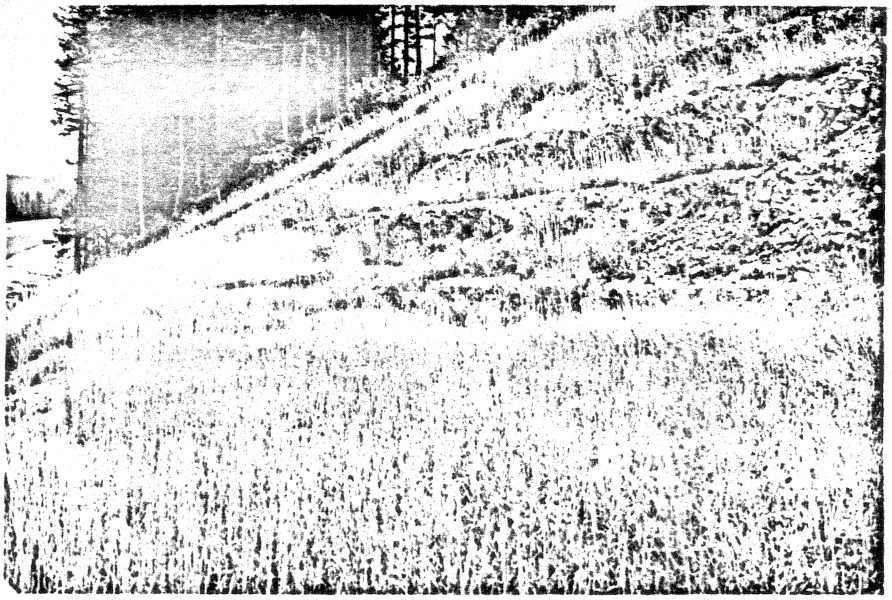


Figure 2.--Plant establishment, although satisfactory on most bench sites, was slower to develop than on fill slopes.



2a.--Average ground cover after one growing season on highly weathered parent materials



2b.--Similar area after two growing seasons.

grasses on all sites. Manipulation of the grass must be achieved during the first and second year following planting to allow the slower developing seedlings a period for adequate establishment. Studies are currently underway to evaluate the most desirable rates of grass seed to be applied in conjunction with the tree and shrub seed mixture. In addition, fertilization trials are being imposed within the study to determine the effects that fertilizer rates and dates of application may have upon controlling the grass competition.

Although tree and shrub seedling losses were recorded as the grass competition reached about 40 percent live cover, second-year survival is still adequate to provide a good array of woody plants. Seedling losses of trees and shrubs have continued through the second year as the grass cover has increased. Survival of individual species within cut or fill surfaces is yet to be determined. Howevever, a general evaluation of the more successful tree and shrub species is presented in Table 1. Plants are rated by their adaptability to particular site conditions, and their competitiveness, as seedlings to grass competition. Care should be given in analysis of this information as the rankings represent only 2 years of study.

Table 1. Adaptation and ranking of tree and shrub seeding to site conditions and grass competition

Species	Adaptation Rating: Mini-benches Rocky Sites	Adaptation Rating: Fill Slope Soil Fines Dominate	Competitive Ability
Ash, green	5[1]	5	4
Ceanothus, deerbrush	1	2	2
C. , snowbrush	2	4	4
C. , wedgeleaf	2	2	3
Bitter cherry	3	1	3
Chokecherry, western	3	3	3
Dogwood	2	3	2
Elder, blue	2	3	3
Douglas-fir	1	2	2
Grand fir	2	3	3
Honeysuckle, tatarian	3	4	3
Larch, western	3	4	3
Locust, black	3	4	4
Maple, Rocky Mtn.	3	3	3
Ocean spray	2	2	2
Rose, Woods	3	3	4
Pine, lodgepole	2	3	2
Pine, ponderosa	3	3	3
Serviceberry, Saskatoon	2	3	2
Peashrub, Siberian	3	3	3
Snowberry, western	2	3	2
Sumac, skunkbush	3	3	3
Syringa	2	2	2

[1] Key to ratings
1 - very poor
2 - poor
3 - fair
4 - good
5 - excellent

A considerable number of transplants were planted throughout the disturbed slopes, and, although the plants were not properly handled, some useful information was obtained. Survival of honeysuckle, autumn olive and black locust are indicative of other species which could be successfully utilized. Losses of ponderosa pine and Douglas-fir transplants on similar sites clearly reflect the changes in site conditions from undisturbed slopes, where more mesic species are vigorously growing. The utilization of native species, however desirable, must be selected from situations similar to the disturbed conditions.

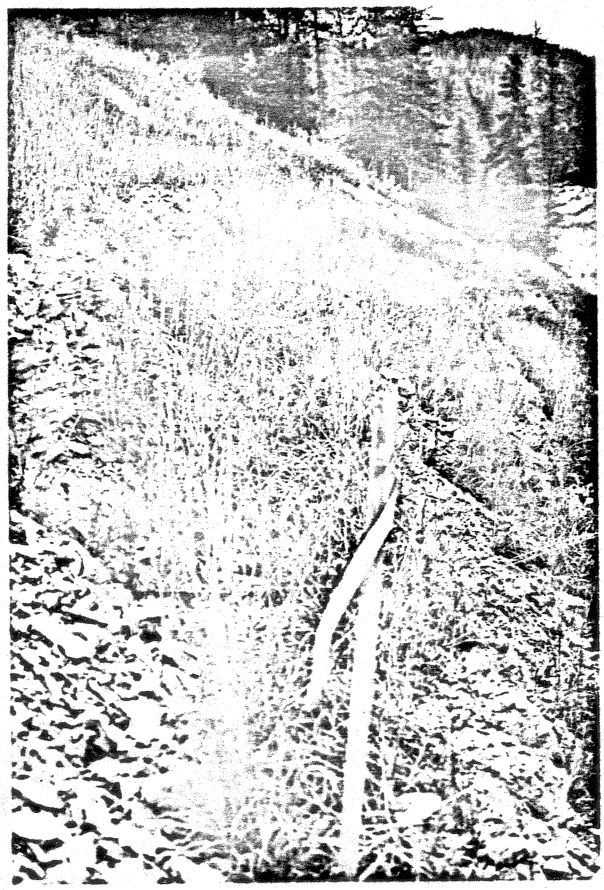
II. Site Preparation and Planting Procedures

Perhaps the most obvious feature of the Lookout Pass route is the serrated series of benches aligning the cut slopes. This treatment has been most successful in providing collection traps where seeds and moisture are retained, permitting plant establishment and development on sites otherwise left unplanted. Benching has been successful in providing good seedbeds even in rocky sites, if the parent material is moderately fractured and breaks into small size rock. Note the difference in plant cover on massive hard rock slopes, as compared to highly fractured and weathered materials (Figures 3-a and 3-b).

The level portions or benches of each small "mini-bench" is the primary region where plants become established. The cut faces, although only about 3 feet in height, are often too steep and unstable to support a dense plant cover. However, it is encouraging to find that a considerable number of seeded tree and shrubs occur within the rocky cut

Figure 3.--Plants are more widely distributed throughout bench slopes where soil fines are present (Fig. 3a), but are scattered on rocky surfaces (Fig. 3b).

3a



3b

slopes. About one-third the number of tree and shrub seedlings were recorded on the cut faces as found on the level bench areas. The benches also provide an interesting comparison to fill slopes in regard to tree and shrub survival. Small pockets of soil materials occur on the benched slopes, surrounded by large areas of bare rock. Individual tree and shrub seeds often collect in these locations, with little or no grass seed. Thus, the subsequent competition problems are alleviated, and the plants have grown very well.

Transplanting is most difficult on the rocky benches because soil fines are not in sufficient supply to cover the roots and eliminate air pockets created by rocky materials. However, if soil fines are present, transplanting can be successfully accomplished.

Planting a heavy rate of grass seed on bench slopes does not appear to be necessary unless the surface requires immediate stabilization or the site may benefit from an aesthetic standpoint. Many of the bench slopes have been cut through hard massive rock, which remains stable. Since erosion or stability problems are not critical, slower developing trees and shrubs could be seeded alone. However, there are slopes which must be planted with a dense understory to control sloughing, particularly if subsurface water drains out of the cuts. Problems exist throughout the Lookout Pass roadcuts and the barrow sites.

III. Environmental Impacts

The Mullan FAA Weather Station, located at the lower edge of the road project, has provided a valuable source of climatic data, which has been most useful in relating periods of seed germination, initiation and cessation of growth, and obvious causes of plant mortality.

Seven individual climatic stations were established during the 1971 growing season to compare temperature and moisture difference throughout the "Montana Line West" route. Although precipitation and temperature patterns were quite similar, small changes were dramatically reflected in growth response. The upper portions of the road, although only about 1,000 feet higher in elevation than the lower sections, remained covered with snow for about 10 days longer than the lower areas. The delay in germination and subsequent plant growth was most apparent. Grasses in the upper site remained nearly one year behind similar species at the lower site. The delay was less noticeable in the growth of the shrubs and trees. Obviously planting dates are most critical to plant survival. Unfortunately spring seedings are often attempted, resulting in poor or weak seedlings.

Quite noticeable differences are now being detected in the growth of plants established upon the various parent materials exposed by cut slopes. Differences undoubtedly will continue to be detected, particularly as changes in the plant composition are expressed.

IV. Plant Composition Changes

The ultimate development of the seeded trees and shrubs will require a number of years to properly evaluate. Initial changes in the seeded grass has progressed as expected. The more rapidly developing timothy and orchard grasses have dominated the seedings, but a general shift to smooth brome and intermediate wheatgrass can be expected.

Although, as mentioned, seeded grasses have suppressed seedling development of tree and shrub species, plants of grand fir, snowbrush ceanothus, Woods rose, and chokecherry have made excellent growth in areas free of excessive competition. Trees and shrubs, which appear to have surpassed the competitive dilemma, should begin to exert pressure upon the understory species, thereby reversing the trend in plant cover. In addition, the effects of the fertilizer, applied at the time of planting, should dissipate and weaken the stand of grass. This should also be reflected in a general shift in favor of the shrubs and trees.

The following statements summarize the major findings developed during the past two years of study:

(1) Broadcast seeding was successful in establishing grasses, forbs, shrubs and trees on all areas, except the Big Creek barrow site which was spring planted. Few tree and shrub seedlings appear from spring plantings as an adequate stratification period was not provided.

(2) Natural selection eliminated some plants during the first two years after seeding, but a satisfactory ground cover developed on all

fill slopes and most benched cuts. Native tree and shrub seedlings have become established and appear adapted to the disturbed slopes.

(3) Plant establishment was weaker on the mini-benches than the fill slopes, with the steep cut faces being the poorer sites. Some seeds failed to survive on the cut slopes, due to sloughing and rapid drying of the shallow surface soils.

(4) Grass competition did reduce shrub and tree survival, particularly on fill slopes. Approximately 20 percent of all tree and shrub seedlings succumbed during the first growing season on fill areas. Of the remaining plants, about 60 percent died in the second season. A satisfactory number of plants remain to adequately stock the fills. Similar losses in woody plants occur on cut slopes, although the percent die-off varies to a great extent among the different bench slopes.

(5) Mini-benching provides a much better trap for retaining broadcast seeds. Although plant numbers and ground cover are lower than on fill slopes, mini-benches provide a much better planting surface than smooth cut slopes.

(6) Excellent seed coverage occurred on all sites from natural settling, and transplanting has been quite successful on slopes where soil fines accumulate. The exposed parent materials are surprisingly productive, although applications of commercial fertilizer is beneficial. In fact, temperance of fertilizer rates appears necessary to reduce the rapid growth of seeded grasses, and allow tree and shrub seedlings time to become better established.

(7) Poor planting techniques are the major reasons that most seedings fail to establish. The primary problems result from areas not being uniformly planted, and from subsequent disturbances to seeded slopes from road construction activities.

STATUS AND PROJECT ACTIVITIES FOR THE 1973-74 PERIOD

At the present time, all studies are on schedule and analysis of field data is being completed. Yearly inventories will be taken of the plots now established, and sampling will be extended to the recently planted Osburn barrow site. In addition, studies were initiated in the fall of 1972 to evaluate the control of grass and shrub competition by regulating seeding mixtures, fertilization rates, and planting dates. No new studies are projected unless they are essential to the Highway Department. Although new areas are being added to this year's sampling, the initial program was designed to evaluate representative sites planted during the 3-year period of road construction.

It is essential that studies be continued to document growth responses for at least a 5-year period. Sufficient information has already been collected to greatly assist in future plantings. The area has received considerable attention from other agencies and private organizations. During the 1972 period, research results were presented in papers delivered during annual meetings of the following organizations:

(1) Inland Empire Reforestation Council

Revegetation of road cut and fill slope in Idaho using native plants.

(2) WASHO - Salt Lake City

Seedling Survival of Native Plant Species on Fill and Serrated Cut Slopes.

(3) Northwest Scientific Association

Plant Succession--A criterion in the Selection of Species for Revegetation of Roads in the Idaho Batholith.

(4) The area was also included in a Field Tour sponsored by the Montana Highway Department to demonstrate construction practices and revegetation accomplishments.